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ABSTRACT

One of six documents describing the Management System for Vocational Education (MISVE), this document is intended to provide those persons who would administer, manage, or support MISVE operations with a basic understanding of the product package. This description of MISVE includes purposes and features, how the system differs from other vocational education management information systems, how MISVE operates, and what it can accomplish. (MISVE was designed to provide users with an advanced management information system (MIS) capability that could effectively respond to current information needs of vocational education managers, to their new and emerging data needs, as well as permit adaptability in meeting the unique operational requirements.) The authors note that the document is written in a basically nontechnical style. Background information about the development of the information and computer software subsystems is included. (SH)

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RESEARCH AND DEVELOPMENT SERIES NO. 127C

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MANAGEMENT INFORMATION SYSTEM FOR VOCATIONAL EDUCATION

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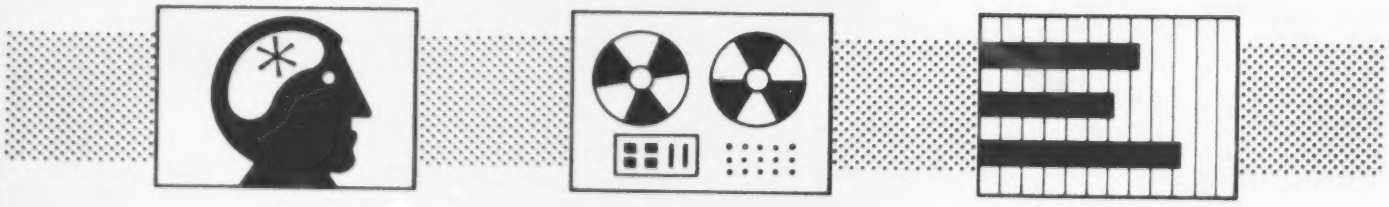
MISVE GENERAL DESCRIPTION



CE 011 895

THE CENTER FOR VOCATIONAL EDUCATION
THE OHIO STATE UNIVERSITY
1960 Kenny Road · Columbus, Ohio 43210

THE CENTER MISSION STATEMENT

The Center for Vocational Education's mission is to increase the ability of diverse agencies, institutions, and organizations to solve educational problems relating to individual career planning, preparation, and progression. The Center fulfills its mission by:

- Generating knowledge through research
- Developing educational programs and products
- Evaluating individual program needs and outcomes
- Installing educational programs and products
- Operating information systems and services
- Conducting leadership development and training programs

RESEARCH AND DEVELOPMENT SERIES NO. 127C

MISVE GENERAL DESCRIPTION

Harold Starr, Program Director

Michael S. Black, Research Specialist

The Center for Vocational Education
The Ohio State University
1960 Kenny Road
Columbus, Ohio 43210

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FOREWORD

Vocational education agencies require management information systems that will assist them in their program planning, evaluation, monitoring and reporting responsibilities. The Management Information System for Vocational Education (MISVE) was designed to provide users with an advanced MIS capability that can effectively respond to current information needs of vocational education managers, as well as to their new and emerging data needs. The system has been planned to permit great adaptability in meeting the unique operational requirements of its users.

Invaluable cooperation and assistance in the development and field trial of MISVE was provided by Robert Stump, project officer, the National Institute of Education; Jack Wilson, project officer, the U.S. Office of Education, Bureau of Occupational and Adult Education, Division of Research and Demonstration; and to the staff of the Colorado State Board for Occupational Education who were involved in the MISVE field trial. Recognition is due also to the staff of MRI Systems Corporation who developed the MISVE applications programs and assisted in the preparation of MISVE documents, to the many state staff persons who served on MISVE applicability panels to review system developments and outputs, and to the many persons who provided reactions and valuable advice for revising the present set of MISVE documents. Significant contributions to the final product were also made by Harold Starr, project director; Michael Black and Kenney Gray, research specialists; and other Center staff.

Robert E. Taylor
Director

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MISVE SYSTEM DESCRIPTION

MISVE SYSTEM DESCRIPTION

1. SYSTEM ADVANTAGES

The Management Information System for Vocational Education (MISVE) has been developed by The Center for Vocational Education (CVE), The Ohio State University. MISVE is designed to allow the acquisition, processing, and retrieval of information in a manner optimally useful for planning, reporting, and accountability purposes. It is specifically designed to deal with the needs of information system administrators who must periodically redefine information requirements, update existing data bases, access stored data in a form and at a time when they are needed, and who must have options open to them for acquiring and maintaining computer software on computer hardware that is available to them. The adaptability of the MISVE data base to the needs of potential users and the options available for acquiring and operating MISVE computer software will enhance the system's usefulness to vocational education agencies that already have heavy investments in MIS and those that have minimal or no MIS but want to initiate or upgrade their current capabilities.

MISVE addresses itself directly to the national concern for better planning and accountability through the availability to management of timely and targeted data-based information. MISVE does so in several ways. In the first instance, the prototype MISVE data base is broad in scope and includes the most current information concerns of vocational educators. Secondly, MISVE is specifically designed for ease in making user-specified data base modifications to meet changing federal, state, and local information needs. Thirdly, output from MISVE can take the form of either standard or ad hoc reports. Staff persons who are not computer programmers can sit at a terminal and interact with (query) the MISVE data base using an English-like syntax. Data in the data base can

be retrieved in this way in many combinations and in a variety of formats. Planners can also query the data base by inserting arithmetical expressions into their query statements. This interactive capability has the potential for promoting improved utilization of information as managers at all levels are able to browse their MISVE data base(s) and retrieve information rapidly. Fourthly, data input and data output are largely independent. When determining what data elements to add to or delete from the prototype data base, it is not necessary to know exactly what questions will be asked of the data base later, nor exactly what reports will be needed. It is only necessary to consider the kinds of information that one wants to have available and how the information can be most conveniently organized.

2. DESIGN RATIONALE

MISVE was originally conceived to provide a data base of information to a variety of system users. Through extensive interaction with the field, it was found that it is difficult, if not impossible, to identify within various agencies all of the potential system users, let alone all of their needs. In the early stages of MISVE development the attempt to identify the needs of most users was based on the traditional methodology for the design of information systems; that is, to make the users define information needs and output specifications so that input requirements could be designed to meet these specifications.

CVE discovered that in the daily operational world of vocational education it was most difficult to clearly and objectively identify information needs. Even where some needs were defined, the dynamics of educational change were such that there was a constant revision of the needs requiring resultant modifications to the information system. Thus, an alternative approach to management information system (MIS)

design had to be conceptualized in order to permit the development of a system that was not output constrained by current information requirements, but was flexible and responsive to changing information requirements. The "data base management system" concept which is input rather than output oriented was selected as the most effective approach for developing an information system that would adequately meet the needs of MISVE users.

The nature of a data based management system can best be appreciated by looking at its precursors. The traditional approach to the creation of MISs involves a needs analysis. A particular information need is identified. A program to create a file is written and tested and the file created. A program is written to upgrade the file. Another set of programs is created, tested, and operated to produce information from the file. To each new information requirement the cycle of problem definition, study of alternatives, design, programming, testing and operation must take place. This is slow, cumbersome, and time-consuming. By the time the information is produced, the original requirements may have changed or disappeared altogether. For example, the data processing section of a state department of education might have programs to create, maintain, and retrieve information from student files, staff files, equipment files, financial files, program files, etc. Whenever some event takes place - a teacher quits, is hired, changes classes, or whatever - it will affect one or more files. Merely managing the maintenance function for a complex of fragmented programs is, in itself, a tremendous job. Seemingly minor changes in the programs - for example, changing the field length in a particular record, or re-defining a data element - can have devastating effects throughout the system. If a question is asked that was not anticipated in the system design, it may be next-to-impossible to answer without spending much time and effort writing special programs.

The whole system is input - output dependent: the output is severely limited by the format of the input and the design of the programs to produce the output. The system can work well for the specific tasks that it was originally designed to do, but it has no flexibility. It cannot easily handle unanticipated needs.

The key to the generalized data-based management approach, unlike the traditional approach just described, is input - output independence. The input, the data elements used in the system, is determined only by consideration of the kinds of information one wants to have available. Output is not determined until the need for the output arises. Suppose that a state director of vocational education decides that he or she needs to know the cost per student per instructional hour for the agricultural production program in District X, or wants to locate all districts in which the average salary for teachers with more than 10 years experience is less than $8,000 per year. In a traditional system there would be no way to answer these questions unless they had been designed into the report generating programs, or someone spent time writing a special program. In a data base management system, the commands for retrieving the information could easily be formulated at the time the question was asked, as long as the information was contained somewhere in the data base. (No system can be totally input - output independent. The cost per student, for example, could not be determined if the data base contained no cost data).

The input oriented data base management system concept also permits taking advantage of the latest advances in computer software technology. Prior to these advances, because of costs and operational inefficiencies of the computer hardware, efforts were made to limit the amount of data maintained "on-line". On-line storage is required for an input-oriented system because many records are created and updated from re-

mote terminals at the data source. With new hardware improvements, coupled with even newer software developments, the cost of on-line storage has been drastically reduced, while storage volume has dramatically increased. With these improvements now available, the fact that an input-oriented system requires on-line storage no longer poses a serious problem of size or cost to the system developer.

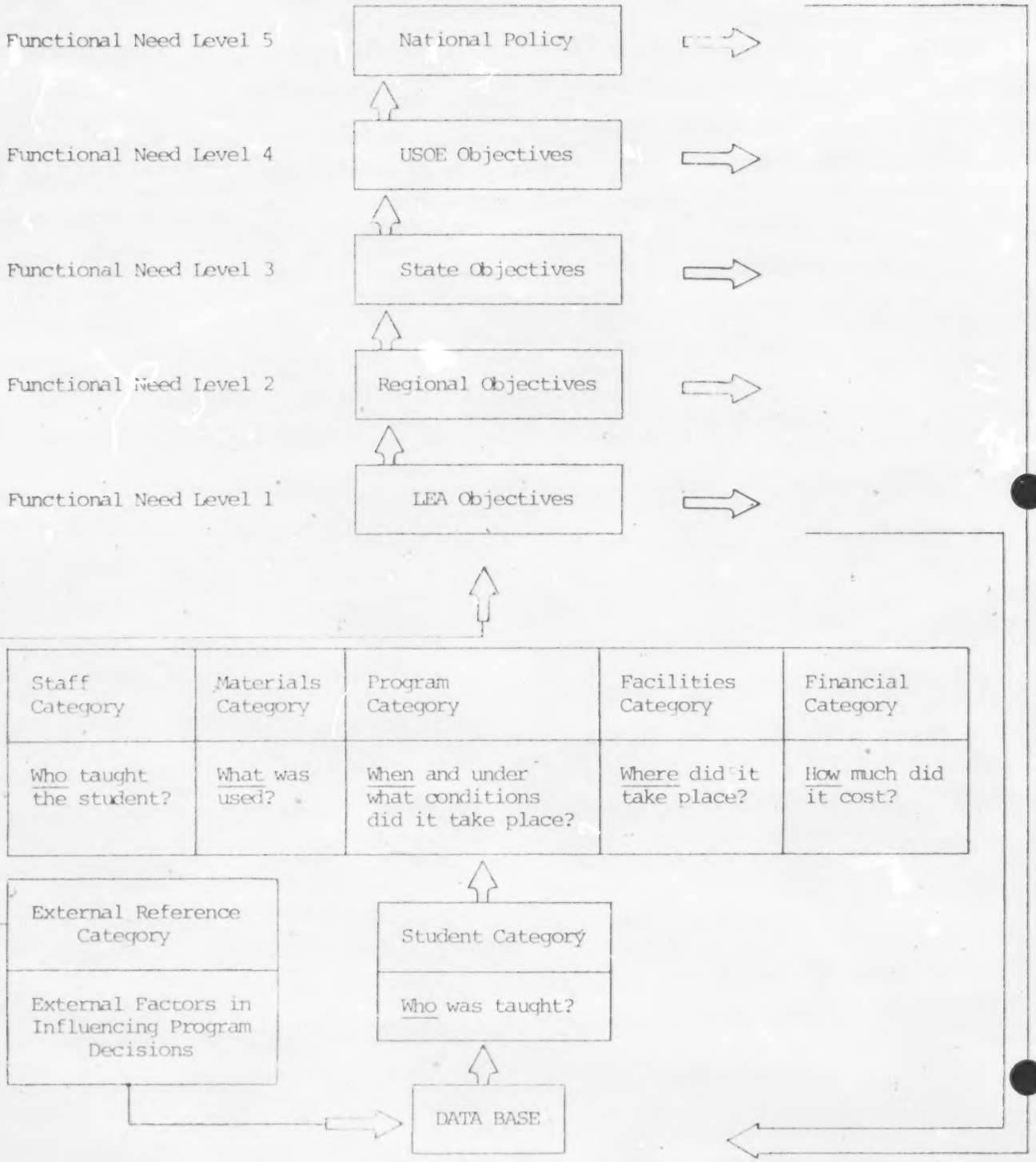
2.1 MISVE Functional Needs Framework

Since it was determined that the needs of an organization were difficult to quantify and that it was even more difficult to build a system designed to meet these unidentified needs, an organizational framework had to be developed through which data would flow. This framework conceptualizes needs as existing at five levels, as "used to contribute to the development or maintenance of a larger whole." The functional needs levels identified for MISVE are intended to "develop or maintain" the organizational structure of the educational system (the larger whole) whose primary purpose is to contribute to the learning continuum of the student. The framework is illustrated in Figure 1, MISVE Functional Needs Levels. At the lowest level are the functional needs of the local education agency, followed by those of the region, the state, the U.S. Office of Education, and, ultimately, national policy.

The framework for the MISVE Functional Needs Levels as depicted in Figure 1 contains six functional categories of data (not files, or specific sections of the data base), and additional reference data obtained from outside sources, e.g., Bureau of Labor Statistics, Bureau of the Census, state pupil enrollment projections. The variety of information which can be included within the functional categories of data are as follows:

Figure 1

MISVE FUNCTIONAL NEEDS LEVELS



Student Data

This category of data contains elements which answer the question, "who was taught"? This category would include elements dealing with student enrollments, characteristics, placement and follow-up experiences.

Staff Data

This category of data contains elements which answer the question, "who was involved in the students learning"? This category includes, for example, professional credentials and assignments. It is possible that in a local level of application, this category could include the personnel files for job applicants.

Equipment and Materials Data

This category of data contains elements which answer the question, "what was used in the students learning program"? Laboratory or shop equipment or special equipment needed for the vocational education instruction of handicapped students would be vocational education instruction of handicapped students would be included here. At the local level this category might include the library book utilization log or the media center film catalog.

Program Data

The contents of this category of data are intended to answer the question, "when and under what conditions did certain student learning experiences occur"? This category would include descriptive data about instructional courses and programs, as for example, program duration and scheduling.

Facilities Data

Elements in this category are intended to answer the question, "where did the learning take place"? This would include,

for example, the physical location and the space allocated for regular classrooms and special facilities.

Financial Data

Elements in this category are intended to answer the question, "what was the cost of instruction"? At Functional Level 2, this could include funding approval reports; at Level 1, this could include the data elements necessary to construct a detailed budget.

Through the capacity of generalized data base management system (GDBMS) computer software to combine data base elements, many needs (or questions) previously unanticipated prior to the initial establishment of the information system can be met. Figure 2, Combining Data Base Elements, illustrates how elements are combined from each category contained in Figure 1, the MISVE Functional Needs Levels.

3. SYSTEM FEATURES

MISVE consists of six components:

- a prototype data base which is primarily state level oriented;
- a prototype set of data collection instruments;
- a commercially available generalized data base management system (GDBMS) computer software package;
- a prototype data base definition and accompanying data base structure which depicts the logical and hierarchical relationships of data elements within the data base;
- applications programs for use with the GDBMS; and
- system documentation.

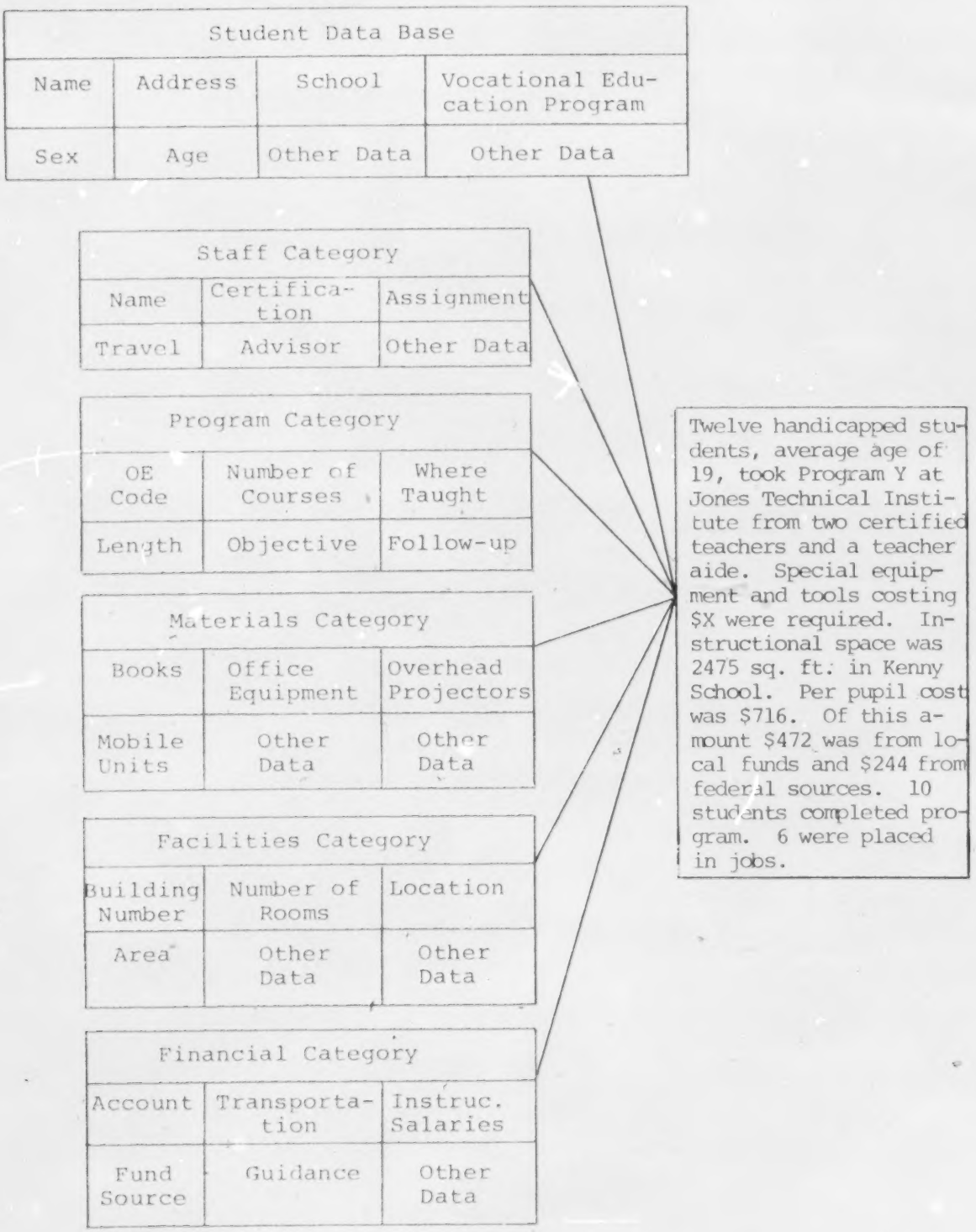
A description of each of the six components of the MISVE product package follows:

3.1 The Prototype Data Base

MISVE provides users with a prototype data base that is not intended to be an exhaustive definition of vocational edu-

Figure 2

COMBINING DATA BASE ELEMENTS



cation data suitable (or necessary) for generating management information; rather, it does provide a broad base from which any user can begin to customize a data base applicable to a particular vocational education agency operating environment.

The MISVE prototype data base is designed to have general applicability for meeting a wide range of management information requirements commonly encountered by many states. The data base includes the following categories of data:

- student data, including characteristics, enrollments, completions, placement and follow-up (individual and aggregate data).
- staff data, including credentials, professional improvement experiences, and assignments.
- program data, including current and projected cost and staff requirements, courses, advisory committee make-up, and descriptive elements useful for planning, evaluation, and accountability purposes.
- equipment and materials data, including requests, costs, and expenditures.
- facilities data, including instructional program space and time utilization, and location.
- manpower demand data, collected from external sources such as the U.S. Department of Labor.
- translation table data, including manpower demand data coding crosswalks, U.S. Office of Education taxonomy of vocational education instructional program titles and codes, county and school district names and codes, and a listing of equipment names and codes.

A detailed list of the data elements in the data base and the characteristics of each is found in the "MISVE Source Data Instruments Input Procedures" document.

3.1.1 development of the prototype data base

Three major phases of activities proceeded current MISVE efforts at resolving the problem of defining an appropriate MISVE data base for inclusion in the input subsystem. The first phase involved the development by CVE of the System for

Statewide Evaluation of Vocational Education. This MIS product was designed to provide a methodology to secure evaluation and accountability data mandated by the 1968 Amendments to the Vocational Education Act of 1963.

In the second phase of MISVE data base development, the focus of MISVE program efforts was directed to the identification of categories of data and data elements that could expand the information base of the System for Statewide Evaluation of Vocational Education to make MISVE more responsive in producing data for use in planning decisions. One strategy used to assist in this identification process was determining major planning decision requirements of state divisions of vocational education (SDVEs) when these agencies functioned as part of an interagency coordinated manpower delivery system. A set of nine categories of data for MISVE was selected during this second MISVE developmental phase.

During phase three of MISVE development, the nine categories of data formulated in phase two were examined to determine how these data categories could be further developed and integrated for use by state level management in allocating resources. Product applicability panels and consultants were used periodically to react to the data base subsystem strategies and resulting products throughout each of the three phases of developmental activities. The results of these external reviews and interactions with persons in the field strongly suggested that much progress had been made toward defining a MISVE data base.

During the fourth and present phase of MISVE development, project staff reassessed earlier MISVE efforts at developing a MISVE data base. This assessment indicated that:

- no typical management style was practiced by the states;
- no consensus existed as to a common set of management decision requirements within or across states; and,

. planning, evaluation, accountability, and reporting requirements for states were fluid or difficult to define.

The changing, diverse, and emerging nature of informational needs required, therefore, that the MISVE data base should be a prototypical one initially derived from common federal-state concerns for vocational education outcomes and focused on those data categories and elements whose integration is pragmatically and judgmentally assumed to have a high probability of being responsive, over time, to management's diverse needs for data.

3.2 The MISVE Prototype Data Collection Instruments

MISVE provides users with a set of prototype source data collection instruments (SDIs). These SDIs are used to collect data at the secondary, post-secondary, and adult levels. A description of the SDIs are found in the "MISVE Source Data Instruments Input Procedures" document.

The prototype source data collection instruments fall into three categories according to the types of data involved: a) administrative data, b) student data in aggregate form, and c) individual student data.

The development of the prototype source data instruments involved a number of procedures. These procedures included examining formats of data collection instruments used by many states, reviewing advantages and disadvantages of different techniques for converting responses into machine readable form, and obtaining suggestions from Colorado field site staff for enhancing instrument acceptability by local school personnel. An agency adopting MISVE can either use MISVE SDIs, incorporate existing state SDIs, borrow SDIs from other states, and/or develop their own SDIs. New data elements can be added or deleted and SDIs modified or replaced; and in many instances, with minimal impact on existing MISVE applications programs used to load and update the MISVE data base.

3.3 The Generalized Data Base Management System Used With MISVE

SYSTEM 2000, developed and marketed by MRI Systems Corporation, Austin, Texas, was selected as the GDBMS for use during the development of MISVE. The decision to use this software package was made after an extensive technical review of generally available data-based management systems. It was selected primarily because of its data management capabilities and the availability of versions for use on computers of three vendors, i.e., IBM, CDC, and UNIVAC. SYSTEM 2000 operates in interactive, remote batch, and batch processing modes and provides a natural (English-like) language for accessing and updating data bases. An optional report writer feature is available for producing, by means of the natural language, more complex one-time and standard reports. Procedural computer language interface programs permit MISVE users to continue to use procedural programming languages, i.e., COBOL, Fortran, and PL/1. A more complete description of generalized data base management system philosophy and SYSTEM 2000 capabilities are found in the "MISVE Technical Description" document.

3.3.1 operating configurations

Acquisition of Software. The user may acquire SYSTEM 2000 or other similar GDBMS software packages in either of three ways:

- the software can be purchased for a one-time charge and run on the users own computer (or one to which the user has access),
- the software can be rented on a monthly-fee basis and run on the users own computer, or
- the user can rent time from a service bureau that already has the software operating.

Regardless of which of the above options is chosen, the user has a choice of several possible hardware configurations:

- use of a remote computer without terminal support. This configuration would require data input and report output to be transmitted by mail or messenger. All computer runs would be in batch-mode only. All input, including Natural Language commands, would need to be keypunched and submitted through a card reader. Output would be available after the run was made.
- use of an on-site computer or a remote computer with an on-site batch terminal. The basic operation would be the same as in optional, but input and output transmission would be direct.
- use of a remote computer with an on-site interactive terminal. Large-scale input and output would need to be transmitted by mail or messenger. Small-scale input and output could be transmitted by keying into or printing onto the terminal. Computer runs could be in either batch - mode or interactive mode. Queries into the data base through Natural Language commands would produce immediate results at the terminal.
- use of an on-site computer, or remote computer with an on-site terminal and an interactive terminal. This configuration would give the user maximum convenience. A choice of batch - mode or interactive mode operation combined with direct input and output would be available.

3.3.2 development of computer software support for MISVE

The development of a prototype computer software support system design for MISVE was initiated in the spring of 1973. An RFP was prepared and a nationally recognized management consulting firm was selected to be the subcontractor responsible for producing a prototypical MISVE computer software design. This prototype computer software design was operationalized in June 1973. A product applicability panel was convened that month and was enthusiastic as to design features and, most especially, to the prototype's limited inquiry capabilities. However, the panel was critical of a lack of sufficient documentation to make members confident that they could implement and maintain the computer software package without

continuous assistance from the subcontractor or The Center.

Shortly, thereafter, The Center requested and received permission from the National Institute of Education (NIE) to have the same subcontractor design a more advanced computer software for MISVE.

An initial step in designing this advanced computer software support system for MISVE was a survey of the states to determine their computer hardware configurations and programmer capabilities. Following this survey, the design of a file management computer software support system for MISVE was initiated.

The MISVE file management system computer software design was presented to a product applicability panel in April 1974. This panel consisted of representatives from eight state divisions of vocational education. These states included those with fairly extensive commitments and activities in the area of MIS, those with minimal systems, and those with no formal MIS but interested in developing MIS capabilities. This meeting was held as part of CVE's in-house, third party, evaluation process. The panel members were enthusiastic about design features of the new software package, but were concerned about proposed documentation levels, potential installation, maintenance and debugging problems, and the services that would be available to them in the event they elected to use the software package.

The panel's opinions, and the conclusions of consultants to MISVE hired prior to the April meeting to review the proposed software design, led CVE, with concurrence by NIE, to discontinue further development of software for two reasons:

- the development design proposed by the subcontractor would not have the advanced features of existing GDBMS software packages; and,
- problems of software system installation and maintenance could be reduced by using commercially available products.

The use of a commercially available computer software package does negate the possibility of CVE disseminating a computer software subsystem. However, in view of the advanced features and tested documentation of available GDBMS, as well as the strong maintenance support already provided by vendor's of GDBMS, a decision was made to use a commercially available GDBMS with MISVE.

Following a joint decision in May 1974 by CVE and NIE to terminate development of a computer software system for MISVE, a study was initiated by MISVE staff to determine the most appropriate commercially available GDBMS for use with MISVE. The study methodology involved three activities. First, a consultant was hired to review available GDBMS against a set of selection criteria. Second, the results of the consultant's findings were reviewed independently by a second consultant. Third, visits were made to educational sites using the GDBMS selected by the consultants to verify that users were satisfied with the product. The criteria supplied to project consultants to assist them in selecting an appropriate GDBMS for use with MISVE, and the methodology and results of consultants' findings are presented in Appendix B, An Evaluation of Data Base Management Systems in the "MISVE Technical Description" document.

3.4 MISVE Data Base Definition and Structure

A prototype data base structure has been developed for MISVE which illustrates a logical and hierarchical network of groups of data within the data base. This structure is found in the "MISVE Technical Description" document. The current data base structure was designed on the basis of judgments concerning relationships of data and the presumed relative frequency by which data would ordinarily be accessed and updated.

A data base definition is provided. The definition is a listing of the SYSTEM 2000 Natural Language commands needed to create the data base on the computer. Each command describes a data base element, including its name and number, field length, picture (format), and element type, as well as its location in the data base. The current data base definition is found in the "MISVE Technical Description" document.

There are no fixed records in the data base. The arrangement of the data in the data base is independent of its arrangement on the input records. Each data element or group of elements is located at its appropriate place in the data "tree". Consequently, data elements can be retrieved interactively with the use of "natural" language commands in nearly any combination, either completely or restricted to specific values.

A data element usually appears only once in the data base definition no matter how many times it appears in data collection instrumentation. Redundant storage and updating of data is thereby reduced or eliminated; and this has the effect of reducing operational costs and enhancing data storage reliability.

An example of eliminating redundant storage of data and reducing updating operations is as follows. Student name appears on several of MISVE source data collection instruments. If traditional flat-file structuring were used, the student name would be inputted on a student file and again on a follow-up file and be stored twice. A change in a student's last name, say by marriage, after leaving school would necessitate that the student file be updated to match the updating or the follow-up file. A failure to go back and perform this updating would result in an inability to match the particular student's educational data with follow-up experiences. In GDBMS philosophy, student name appears only once in the data base

requiring only one updating and thereby reducing the probability of "mismatching" and reducing data storage requirements.

3.5 Applications Programs for Use With MISVE

MISVE users are provided with six applications programs written in ANSI COBOL. These six computer programs are used to load and maintain the MISVE data base. One program, SORTKEY, utilizes the COBOL sort verb facility; one program, EDIT, is a stand alone program. The four remaining programs access the data base using the SYSTEM 2000 Procedural Language Interface (PLI) facility. From another perspective, four programs, EDIT, SORTKEY, LOAD, and TABLOAD are used for the initial loading of data into the data base; two programs, UPSTAFF and UPSTUD are used to add data to or modify data already in the data base. The load and update programs are needed only with large amounts of data. Small amounts of data and minor modifications can easily be handled by SYSTEM 2000 Natural Language.

The EDIT program screens the input data, flags and deletes cards that contain certain kinds of errors, and makes some coding modifications that are necessary for further processing. The EDIT program searches for format errors on individual cards, but does not locate errors resulting from incorrect relationships among cards. The SORTKEY program sorts the output of the EDIT program into the proper sequence for loading or updating the data base. The LOAD program loads all data, except data for the translation tables, into the data base. The TABLOAD program loads translation table data into the data base. The UPSTAFF program adds to and/or modifies staff data already in the data base. The UPSTUD program adds to and/or modifies student and administrative data already in the data base.

3.6 MISVE Documentation

Six documents have been written for use with MISVE. These

six documents are provided to potential system users to guide them in assessing the value of MISVE for their needs and to provide information needed by them to adopt and install MISVE. The documents in themselves are not assumed to be sufficient to enable a potential user to adopt MISVE without additional technical assistance from CVE.

These documents are titled:

- MISVE Document Catalogue
- MISVE Executive Summary
- MISVE General Description
- MISVE Technical Description
- MISVE Administrators' Orientation
- MISVE Source Data Input Procedures

The "MISVE Document Catalogue" contains an overview and a table of contents for each of the other five MISVE documents. Each overview describes the purposes for the document, the audience(s) to whom the document is directed, and a summary of its contents.

The "MISVE Executive Summary" provides a brief overview of MISVE purposes and features. It is directed to vocational education administrators interested in management information systems.

The "MISVE General Description" provides a more detailed description of MISVE, than does the "MISVE Executive Summary". It includes such information as system purposes and features, how it differs from other systems, how it operates, and what it can accomplish. This document is directed to management information system managers and to vocational education administrators.

The "MISVE Administrators' Orientation" is directed toward those persons who are responsible for implementing and managing management information systems. It includes planning information and resource requirements needed by the administrator for a MISVE implementation.

The "MISVE Technical Description" document is directed toward those persons who supervise computer software operations of management information systems. This document contains the technical details necessary for understanding SYSTEM 2000 and how it interfaces with MISVE, and describes the computer program used to load and maintain the MISVE data base.

The "MISVE Source Data Input Procedures" document is a reference manual for MISVE data input clerks and technical support personnel. It includes coding instructions, scheduling, keypunch instructions, and card layout formats for the prototype source data instruments. Information is also provided for modifying and revising input procedures to reflect local requirements.